TWO TONE A.F. SIGNAL
GENERATOR TYPE 745

INSTRUCTION MANUAL

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TWO TONE A.F. SIGNAL GENERATOR TYPE 745

C O N T E N T S

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1. General

This Plug-In is designed to provide simultaneously two independent Audio signals for the evaluation of intermodulation distortion on Amplifiers, Transmission Links and Single Sideband Circuits. Each Audio Signal can also be used separately for straight harmonic distortion analysis.

It consists of two identical R-C tuned oscillators of high stability and very low harmonic distortion. The frequency and output level of these oscillators can be varied independently and the outputs are combined in a resistive adding network with negligible intermodulation and frequency pulling and fed to a common 600Ω output attenuator.

2. Specification

Each Oscillator

Frequency Range:	30c/s - 30Kc/s in three ranges.
Setting Accuracy:	3% ± 3c/s
Frequency Stability (Short term):	0·01%
Output Level:	0-3V open circuit
Setting Accuracy:	± ·5db
Harmonic Distortion:	0·1% (less than 1% below 300c/s).
Hum and Noise:	0·05%

Overall Specification

Inherent Intermodulation	Better than 80db
Output Attenuator:	0-80db in 10db steps
Output Impedance:	600Ω ±2%

3. Operation

The Two Tone Signal Generator Plug-In is ready for use as received from the factory and when inserted into the Type 70 or 70/R Meter Unit will give the specified performance after about 15 minutes warm-up time. The main function switch in the centre of the front panel has three positions marked A, A & B and B. In the two extreme positions only signal A or signal B is switched to the output attenuator and hence the output terminals, but in the centre position both the signals are combined and at the same time the meter circuit which monitors the output level of the signals is disconnected as it would give a completely false reading. The frequency of each oscillator is set by the three position range switch and the continuous tuning dial and the output level by the appropriate level setting potentiometers. The output level attenuator which is common to both signals provides for setting the open circuit output voltage from 3 Volts down to 300μV when the meter reads full scale in 9 steps of 10db attenuation per step.

The internal output impedance of the instrument is 600Ω and constant irrespective of attenuator setting. Therefore the actual voltage V appearing across the output terminals will depend on the load resistance R and is given in terms of the open circuit voltage E as measured on the meter by the following formula

$$V = E \times \frac{R}{600+R}$$

4. Technical Description

The circuit diagram is shown in drawing BC.1189 and as the two oscillators are identical only Tone "A" Oscillator will be described. The oscillator used is of the "Wien Bridge" type where V_1 and V_2 comprise the maintaining amplifier. The triode section V_2B is used as a directly coupled cathode follower to provide a low impedance output for the Wien Bridge feedback network. Positive feedback is applied via the Wien Bridge to the grid of V_1 which induces oscillations at the "resonant frequency" of the network while negative feedback is applied to the cathode of V_1 through the thermistor TH.1 to stabilise the output amplitude. The Wien Bridge network is switched in three stages by switch S_1 which brings in different values of capacitance for the different ranges and is continuously tuned across each range by the ganged potentiometer RV_1 and RV_2. Because both the H.T. and heater supply voltages of the oscillator valves are stabilised, this results in good frequency stability with mains variation and virtually no mains hum at the output.

The output voltage is taken from the cathode of V2B to the "Level" potentiometer RV5 and hence to the output cathode follower V_3. This is of the augmented type with additional feedback from the anode of V3A to the grid of V3B resulting in an output impedance of only a few ohms. This now drives, via the function switch S3, the star network of R40, R41 and R42 which combines the signals and applies them to the output attenuator. The signal is also applied to the rectifier MR3 and passed to the metering circuit via the pre-set potentiometer RV7.

The output attenuator is shown in drawing AC 1108 and consists of one 10db T-pad, one 20db T-pad and two 30db π-pads all of 600 ohms impedance. Switch S4 switches the various pads so as to get attenuation from 0 to 80db in 10db steps, i.e. an output voltage of 3V to 300μV in 3, 1, 0.3 sequence.

PARTS LIST

CIRCUIT REF.	DESCRIPTION			
ATTENUATOR				
R50.	Resistor, Hi-Stab	491Ω	± 1%	¼W
R51.	Resistor, Hi-Stab	312Ω	± 1%	¼W
R52.	Resistor, Hi-Stab	121Ω	± 1%	¼W
R53.	Resistor, Hi-Stab	312Ω	± 1%	¼W
R54.	Resistor, Hi-Stab	422Ω	± 1%	¼W
R55.	Resistor, Hi-Stab	491Ω	± 1%	¼W
R56.	Resistor, Hi-Stab	639Ω	± 1%	¼W
R57.	Resistor, Hi-Stab	639Ω	± 1%	¼W
R58.	Resistor, Hi-Stab	639Ω	± 1%	¼W
R59.	Resistor, Hi-Stab	9.5kΩ	± 1%	¼W
R60.	Resistor, Hi-Stab	639Ω	± 1%	¼W
R61.	Resistor, Hi-Stab	9.5kΩ	± 1%	¼W
S4.	Switch	Dymar Drawing No. BD 1185		

P A R T S L I S T

CIRCUIT REF.	DESCRIPTION			
R E S I S T O R S				
R1.	Hi-Stab	2·7KΩ	± 1%	¼W
R2.	"	2·7KΩ	± 1%	¼W
R3.	"	4·7KΩ	± 1%	¼W
R4.	"	4·7KΩ	± 1%	¼W
R5.	Carbon	100Ω	± 5%	½W
R6.	"	100Ω	± 5%	½W
R7.	"	15KΩ	± 5%	½W
R8.	"	1KΩ	± 5%	½W
R9.	"	15KΩ	± 5%	½W
R10.	"	1KΩ	± 5%	½W
R11.	"	1KΩ	± 5%	½W
R12.	"	1MΩ	± 5%	½W
R13.	"	1KΩ	± 5%	½W
R14.	"	1MΩ	± 5%	½W
R15.	"	33KΩ	± 5%	½W
R16.	"	1KΩ	± 5%	½W
R17.	"	33KΩ	± 5%	½W
R18.	"	1KΩ	± 5%	½W
R19.	"	33KΩ	± 5%	½W
R20.	"	33KΩ	± 5%	½W
R21.	"	10KΩ	± 5%	2W
R22.	Hi-Stab	2·2KΩ	± 1%	1W
R23.	Carbon	10KΩ	± 5%	2W
R24.	Hi-Stab	2·2KΩ	± 1%	1W
R25.	Carbon	1KΩ	± 5%	1W
R26.	"	1·5MΩ	± 5%	½W
R27.	"	1MΩ	± 5%	½W
R28.	"	1KΩ	± 5%	1W
R29.	"	1·5MΩ	± 5%	½W
R30.	"	1MΩ	± 5%	½W
R31.	"	1MΩ	± 5%	½W
R32.	"	1MΩ	± 5%	½W
R33.	"	2·7KΩ	± 5%	1W

P A R T S L I S T

CIRCUIT REF.	DESCRIPTION			
R E S I S T O R S				
R34.	Carbon	2·2KΩ	± 5%	½W
R35.	"	2·7KΩ	± 5%	1W
R36.	"	2·2KΩ	± 5%	½W
R37.	"	1KΩ	± 5%	1W
R38.	"	1KΩ	± 5%	1W
R39.	"	1KΩ	± 5%	½W
R40.	Hi-Stab	1·8KΩ	± 1%	¼W
R41.	"	1·8KΩ	± 1%	¼W
R42.	"	1·8KΩ	± 1%	¼W
R43.	"	100KΩ	± 1%	¼W
R44.	Carbon	22K	± 5%	1/3W
R45.	"	22K	± 5%	1/3W

RV1.) RV2.)	Dual Ganged potentiometer Inverse semi-log law, 50KΩ ± 5%	
RV3.) RV4.)	Dual Ganged potentiometer Inverse semi-log law, 50KΩ ± 5%	
RV5.	Potentiometer, linear 100KΩ	½ watt
RV6.	Potentiometer, linear 100KΩ	½ watt
RV7.	Potentiometer, linear 22K	

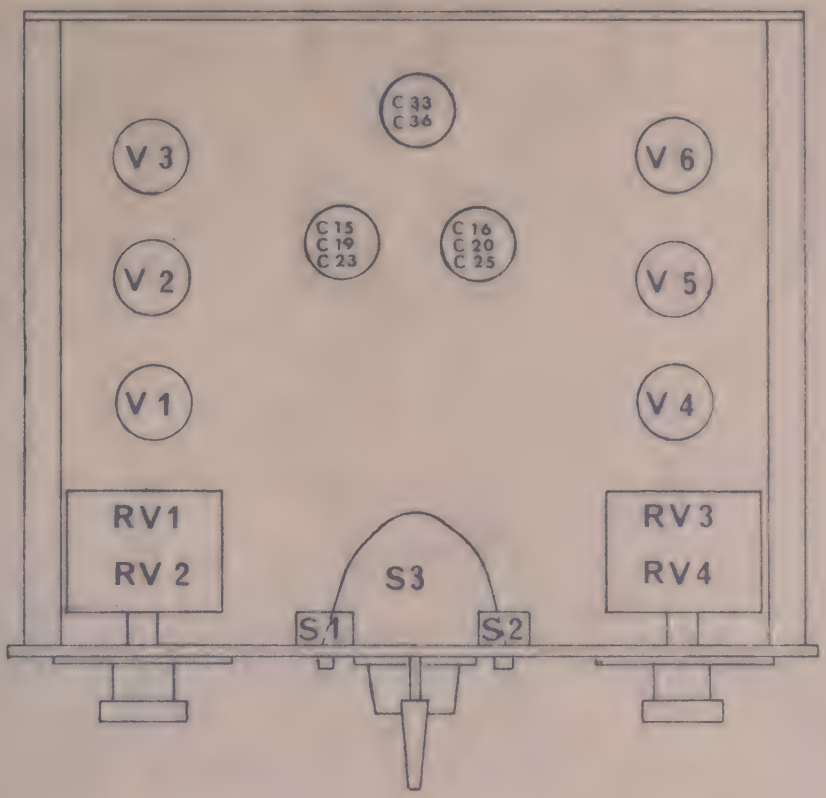
C A P A C I T O R S			
C1.	Plastic Film	0·1μF	160V d.c.
C2.	" "	0·1μF	160V d.c.
C3.	Polystyrene	0·01μF	125V d.c.
C4.	"	0·01μF	125V d.c.
C5.	"	940pf	125V d.c.
C6.	"	940pf	125V d.c.
C7.	"	940pf	125V d.c.
C8.	"	940pf	125V d.c.

P A R T S L I S T

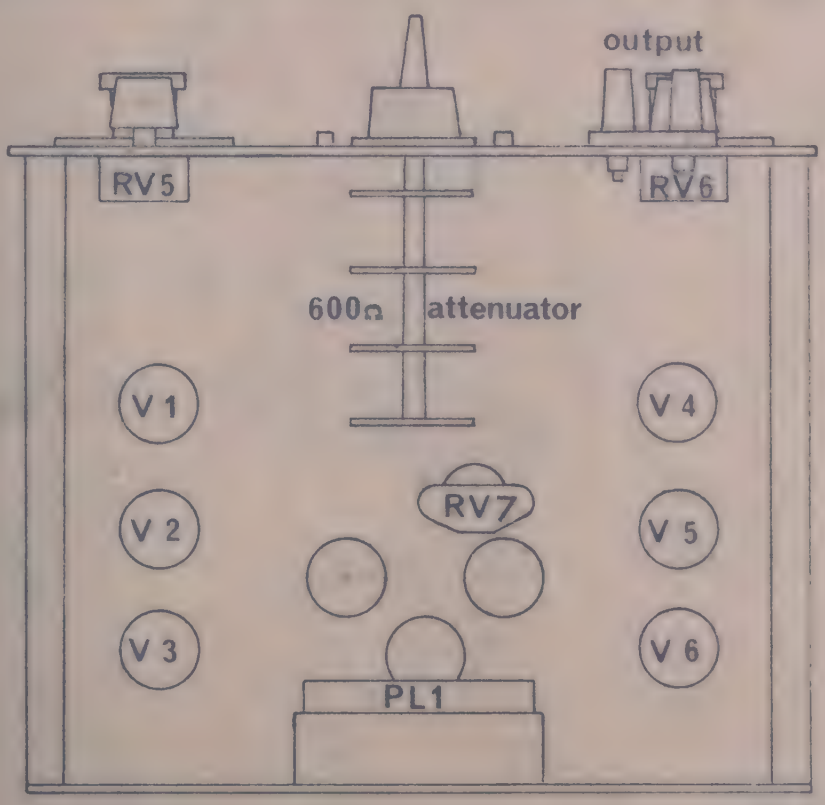
CIRCUIT REF.	DESCRIPTION		
	C A P A C I T O R S		
C9.	Polystyrene	0.01µF	125V d.c.
C10.	"	0.01µF	125V d.c.
C11.	Plastic Film	0.1µF	160V d.c.
C12.	Plastic Film	0.1µF	160V d.c.
C13.	Polyester	·47µF	400V d.c.
C14.	"	·47µF	400V d.c.
C15.	Electrolytic	16+16+16µF	275V d.c.
C16.	Electrolytic	16+16+16µF	275V d.c.
C17.	Polystyrene	100pF	125V d.c.
C18.	"	100pF	125V d.c.
C19.	See C.15		
C20.	See C.16		
C21.	Electrolytic	8µF	150V d.c.
C22.	"	8µF	150V d.c.
C23.	See C.15		
C24.	Polyester	·47µF	400V d.c.
C25.	See C.16		
C26.	Polyester	·47µF	400V d.c.
C27.	"	·1µF	400V d.c.
C28.	"	·1µF	400V d.c.
C29.	"	·047	400V d.c.
C30.	"	·047	400V d.c.
C31.	Electrolytic	50µF	150V d.c.
C32.	"	100µF	12V d.c.
C33.	"	50+50µF	275V d.c.
C34.	"	50µF	150V d.c.
C35.	"	100µF	12V d.c.
C36.	See C.33		
C37.	Electrolytic	8µF	150V d.c.

P A R T S L I S T

CIRCUIT REF	DESCRIPTION		
V A L V E S			
V1.	Double triode	ECC83	Mullard
V2.	Triode-pentode	ECF80	Mullard
V3.	Double-Triode	ECC88	Mullard
V4.	Double-Triode	ECC83	Mullard
V5.	Triode-Pentode	ECF80	Mullard
V6.	Double-Triode	ECC88	Mullard
M I S C E L L A N E O U S			
MR1.	Diode	OA91	Mullard
MR2.	Diode	OA91	Mullard
MR3.	Diode	OA91	Mullard
TH1.	Thermistor	A15	S.T.C.Ltd.
TH.2	Thermistor	A15	S.T.C.Ltd.
PL1.	Plug 16-way Dowel Polarized McMurdo R.P.D.16		
S1.	Switch, slider type RA2300 Ariel Ltd.		
S2.	Switch, slider type RA2300 Ariel Ltd.		
S3.	Switch Dynar Drg. No.BD 1192		



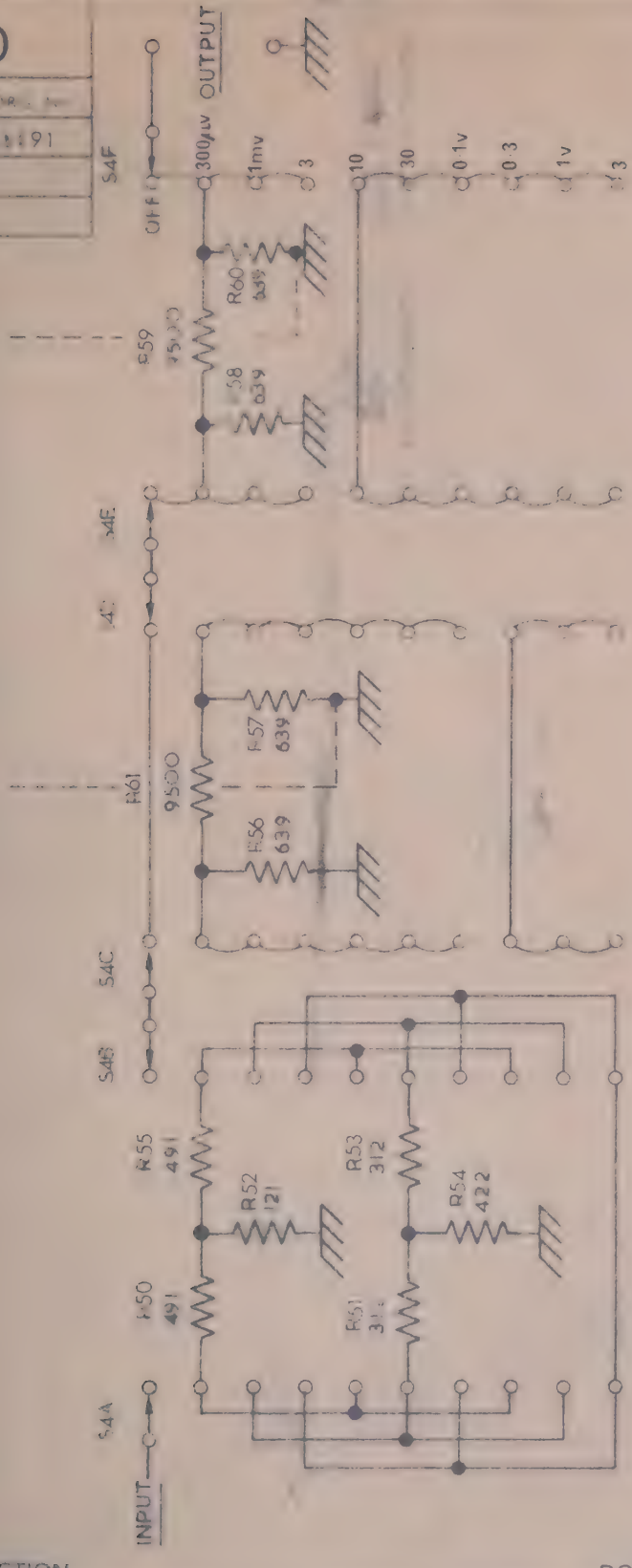
VIEW ON TOP OF CHASSIS



VIEW UNDER CHASSIS

DRG No
AC1190

VERSION	ASSY DRG No
TYPE 745	DA1191



80db. OUTPUT ATTENUATOR.

THIRD ANGLE PROJECTION

DO NOT SCALE

ISSUE	DATE	
A	6.12.65.	

UNLESS OTHERWISE STATED AS FOLLOWS
FRACTIONAL DIMENSIONS .015 CLEAR HOLES .005
DECIMAL DIMENSIONS .005. ANGLES ±1°
DIMENSIONS APPLY BEFORE PLATING UNLESS OTHERWISE STATED

MAT'L — SPEC —
FINISH —
ALL DIMENSIONS IN INCHES SCALE

TITLE CIRCUIT DIAGRAM.
TWO TONE A.F. SIGNAL GENERATOR
OUTPUT ATTENUATOR.

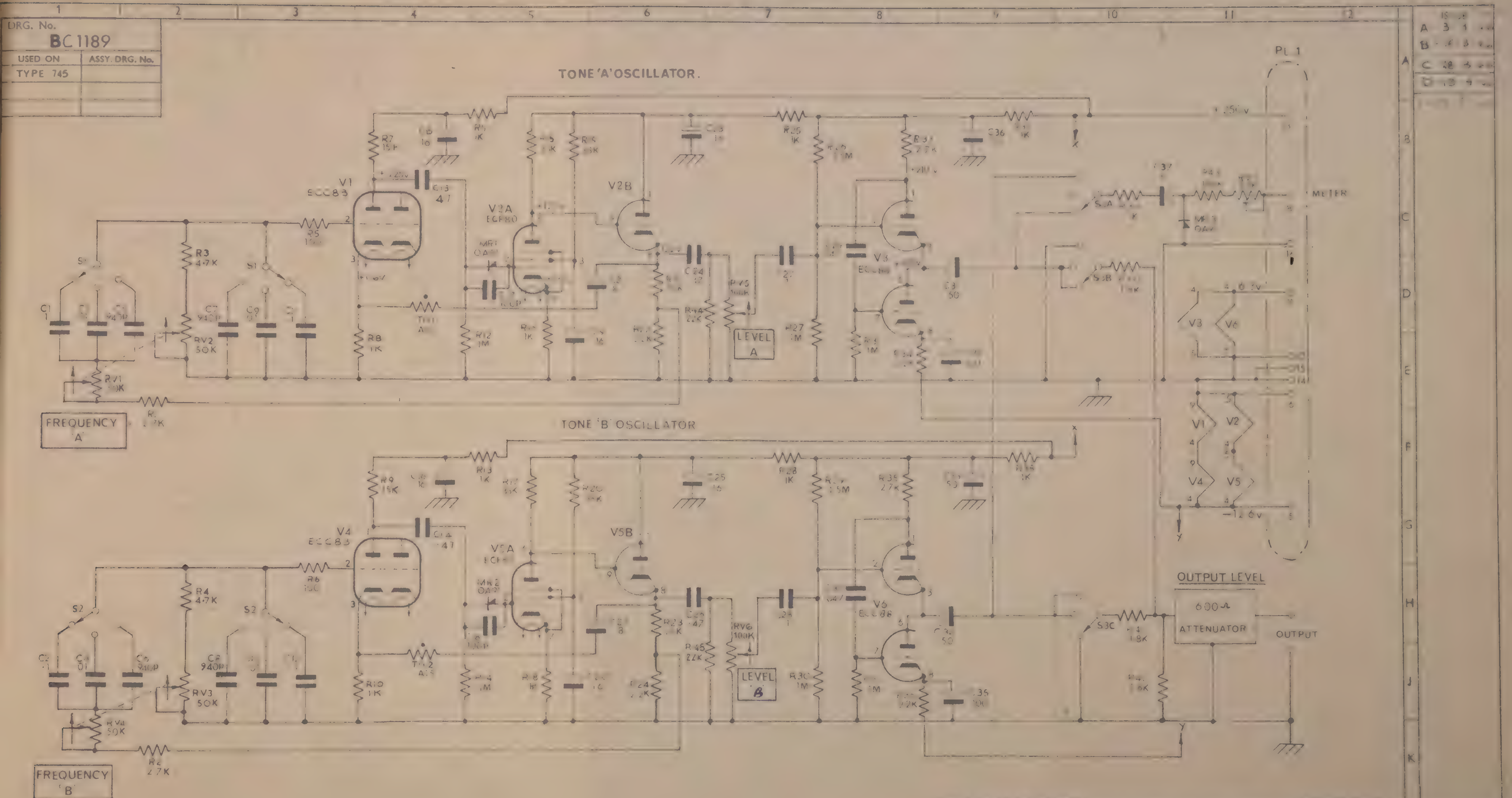
DRG No
AC1190

DRN DA RUSSELL 27.2.65
CHKD
DATE

DYMAR ELECTRONICS LTD.
WATFORD, HERTS, ENGLAND

DRG. No. BC 1189

USED ON	ASSY. DRG. No.
TYPE 745	


TONE 'A' OSCILLATOR.
TONE 'B' OSCILLATOR
V1 ECC83
V2A ECF80
V2B
V3 ECC88
V4 ECC83
V5B
V6 ECC88
R3 4.7K
R4 4.7K
RV1 50K
RV2 50K
RV3 50K
RV4 50K
R7 15K
R8 1K
R9 15K
R10 1K
R12 1M
R13 1K
R25 1K
R27 1M
R28 1K
R30 1M
R35 2.7K
R44 22K
R45 22K
R23
R24 2.2K
R2 2.7K
C1 1
C2 1
C4 01
C6 940P
C7 940P
C8 940P
C9 01
C14 47
C24 47
C25 16
C35 100
C36
MR1 OA91
MR2 OA91
RV5 100K
RV6 100K
LEVEL A
LEVEL B
FREQUENCY 'A'
FREQUENCY 'B'
S1
S2
S3A
S3B
S3C
PL 1
+250V
METER
MR3
6.3V
-12.6V
V3
V6
V1
V2
V4
V5
OUTPUT LEVEL
600Ω ATTENUATOR
OUTPUT
X
Y

THIRD ANGLE PROJECTION

DO NOT SCALE

LIMITS UNLESS OTHERWISE STATED AS FOLLOWS	
FRACTIONAL DIMENSIONS ± .015	CLEAR HOLES
DECIMAL DIMENSIONS ± .005	ANGLES
DIMENSIONS APPLY BEFORE PLATING UNLESS OTHERWISE STATED	
MAT.	SPEC.
FINISH	
ALL DIMENSIONS IN INCHES	SCALE

DYMAR ELECTRONICS LTD.
WATFORD, HERTS, ENGLAND.

TITLE: TWO TONE A.F. SIGNAL GENERATOR

DRG. No. BC 1189

DRN. J. [illegible] DATE [illegible]

CHKD.

APPD.

GUARANTEE

In lieu of any warranty, condition or liability implied by law, our liability in respect of any defect in or failure of the goods supplied, is limited to making good by replacement or repair defects which, under proper use by the original purchaser, appear therein and arise solely from faulty materials or workmanship within a period of twelve calendar months after the original goods shall have first been dispatched, at the termination of which period all liability on our part ceases; provided always that such defective instruments are carefully packed and returned free to our Works unless otherwise arranged, and provided that they have not been tampered with in any way.

For components not of our manufacture we extend only such benefits as we may receive under any guarantee given to us by the makers thereof.

The liability of the Company for consequential loss or damage suffered by the Purchaser of goods supplied by it, howsoever sustained is hereby expressly excluded.

Our equipment has been designed and tested for use with the specific types of components supplied by us therein and no responsibility can be accepted for the performance of the equipment if other components are employed.

In the event of failure or malfunctioning of any equipment supplied by us please contact our Service Department, at the below stated address and give full details of the fault together with the Type and Serial number of the equipment in question.

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